Research Report

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Relationships between Functional Movement Screen, VAS, ODI and Back Endurance in Individual with Nonspecific Chronic Low Back Pain

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Background Nonspecific chronic low back pain (NCLBP) needs intervention for the management of pain and functional problems. Providing the same intervention in heterogeneous groups of subjects with NCLBP does not deliver effective back pain management. Recent studies have recommended NCLBP by classifying subjects into homogeneous groups.

Purpose The purpose of the present study is to determine whether FMS scores could evaluate the physical function of subjects with CLBP and to identify a relationship between the VAS and FMS, the ODI and FMS, and trunk endurance and FMS.

Study design Case-series study.

Methods 29 subjects with NCLBP were recruited and a relationship between trunk endurance, or VAS, or ODI and FMS was identified.

Results VAS (r=−0.409, p<0.05) and the ODI (r=−0.473, p<0.01) were negatively correlated with the FMS. The FMS was positively correlated with the back endurance test (r=0.381, p<0.041).

Conclusions FMS may assist in designing more effective individualized treatment plans to improve the functional capacity of subjects with CLBP.

Key words Classification; Nonspecific chronic low back pain; Trunk endurance test.

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INTRODUCTION

NCLBP may result in both impaired physical functions and psychosocial problems. NCLBP subjects can experience depression, work disability, and deteriorated nociceptive sensations.[1] Measures in NCLBP management may be useful in clinical decision-making and in identifying change related to the focused condition.[2] However, one of the most difficult tasks associated with the management of LBP is clinical assessment.[3]

Some researchers have conducted self-reported questionnaires or measurement tools related to low back disability to assess daily function.[3] The ODI is often used to evaluate disability related to LBP, and the VAS is a widely used method for the clinical assessment of pain intensity.[4] Research has developed to assess psychological problems and functional disabilities to make objective assessments for subjects with CLBP.[3,5,6]

Some researchers attempted to analyze the functional status or functional results obtained after therapeutic intervention. The back endurance test is commonly used to measure the capacity of the back muscles and trunk extensor fatigue.[7,8] People with CLBP seem to have low trunk muscle strength and a low fatigue threshold.[9] Generally,

static back endurance in subjects with CLBP has been examined using the Biering-Sorenson test, the most widely used test in functional assessment.[10,11,12] It often uses sit-to-stand and stand-to-sit tests to assess limited hip and lumbar spine motions in subjects with LBP.[13] It also uses standing on one leg to assess decreased kinetic and kinematic stability.[14] Previous studies suggested a back pain scale with five tasks for the assessment of mobility-related daily activities in people with back pain[13,14]. Although simple function tests are commonly used for subjects with CLBP, their integrated functions regarding daily activities is not being assessed.

FMS is used as a musculoskeletal assessment method. The tasks consist of a deep squat, hurdle step, inline lunge, shoulder mobility, active straight leg raise, push-up, and rotational stability.[2] FMS task performance is evaluated using standardized verbal instructions and visual inspection. FMS scores include movement conditions with or without pain and symmetrically for task performance. The primary goal of FMS is to evaluate ability a combination of physical activities such as flexibility, range of motion, muscle strength, coordination, balance, and proprioception[2,15] and to predict the general risk of musculoskeletal conditions and injuries.[2,16,17]

In a study by Mitchell et al., there is a positive correlation between core strength and FMS (r=0.31, p=0.006) in school children.[18] Deydre et al. reported a positive correlation between back endurance and FMS (r=0.30, p=0.01), Y-balance test (r=0.49), and flexibility (r=−0.28) in healthy soldiers.[19] Christoper et al. did not find a relationship between FMS and athletic performance.[20] In several studies not yet used to assess subjects with CLBP in particular, there is no relationship investigated between disorder assessment tools such as the VAS, ODI, and back endurance tests. Therefore, the objective of this study is to determine whether FMS scores could evaluate the physical function of subjects with CLBP and to identify a relationship between the VAS and FMS, the ODI and FMS, and trunk endurance and FMS.

METHODS

Subjects

Twenty-nine subjects from 23-65 years of age participated in this study. All participants had LBP lasting more than 12 weeks with or without lower leg pains. Their mean age, height, and weight were 45.8±14.4 years, 161.8±7.3 cm, and 60.0±9.8 kg respectively. Exclusion criteria were subjects with neurological diseases, scoliosis, kyphosis, ankylosing spondylitis, shoulder pain, cancer, rheumatoid arthritis, and people who had ever undergone spinal surgery. The Institutional Research Review committee of Inje University gave ethics approval, and all participants reviewed and signed informed consent forms before volunteering.

Procedures

To assess physical function, FMS and back endurance tests were used. Pain level and disability were assessed using the VAS and ODI.[3]

The Sorensen test is used as method for testing isometric back endurance; it measures how long the subject can maximally maintain the unsupported trunk horizontally while lying prone with a fixed pelvis and, knees and ankles held by straps on a test table (Figure 1).[8,9] The FMS includes seven tasks: a deep squat, hurdle step (right and left), active straight leg raise (right and left), rotary stability (right and left), inline lunge (right and left), push up, and shoulder mobility (right and left) (Figure 2). The test is rated on a 21-point scale. If pain is perceived during task execution, a score of zero is assigned.[2]

Statistical analysis

The data of all the subjects were analyzed with descriptive statistics, and the results were reported as mean±SD. The relationships between FMS and the other measurement tools were analyzed using Pearson's correlation coefficient.

Table 1. Demographic characteristics of subjects with NCLBP

Characteristics	Value
Gender (M/F)	7/22
Age (years)	45.8±14.4
Height (cm)	161.8±7.3
Weight (kg)	60.0±9.8

Data are expressed as mean±SD.
Abbreviations: NCLBP, nonspecific chronic low back pain; M, male; F, female.

Figure 1. Trunk extensor endurance test.

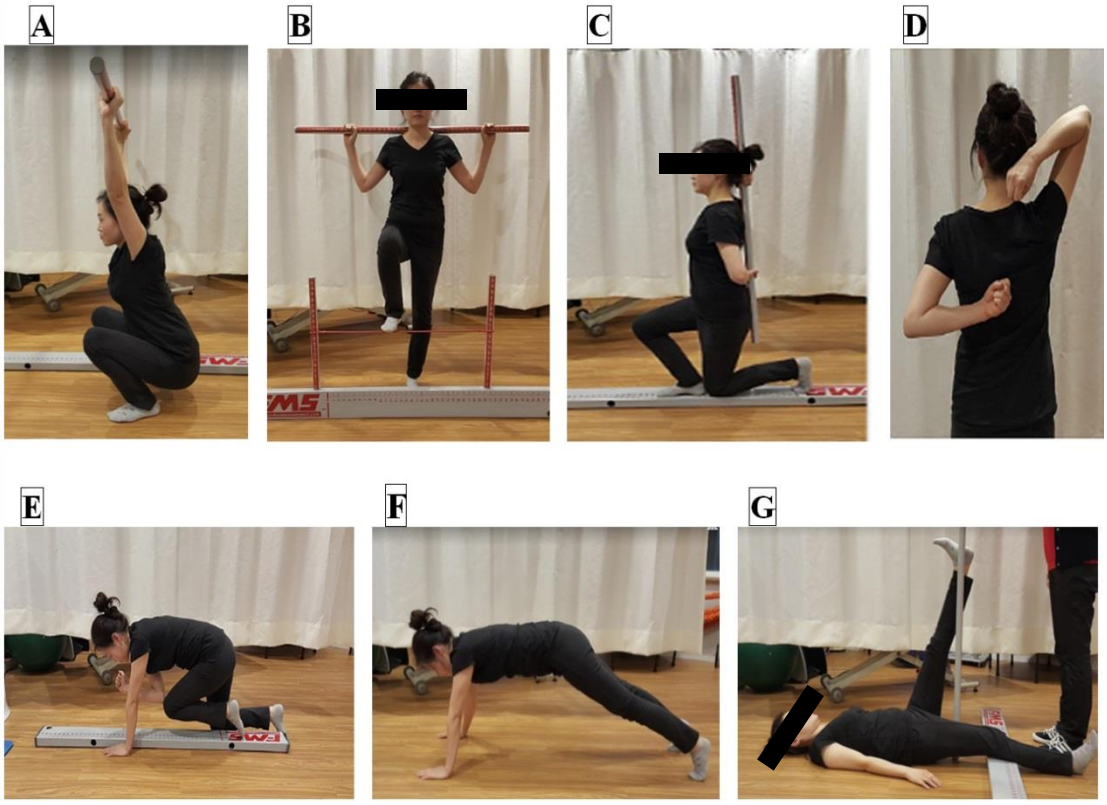

Figure 2. Seven tasks of functional movement screening (FMS).
(A) Deep squat, (B) Hurdle step, (C) Inline lunge, (D) Shoulder mobility, (E) Rotary stability, (F) Push-up, (G) Active straight leg raise.

The variables were assessed for outliers, and the criterion for an outlier was set at >3 standard deviations (SDs) from the mean value. Statistical Package for the Social Sciences (SPSS) ver. 18.0 (SPSS Inc., Chicago, USA) was used for analyses, and the significance was the adopted value of $p<0.05$.

RESULTS

FMS scores averaged 10.6. There was a statistically significant negative correlation between FMS and ODI scores ($r=-0.473$, $p<0.01$), and the FMS and VAS scores ($r=-0.409$, $p<0.05$), respectively. The back endurance ($r=0.381$, $p<0.041$) positively correlated with FMS scores (Table 2) (Figure 3).

Table 2. Correlations between ODI, VAS, trunk extensor endurance test, and FMS (n=29)

	ODI	VAS	Trunk extensor endurance test
FMS	−0.473**	−0.409*	0.381*

* $p<0.05$, ** $p<0.01$.
ODI, oswestry disability index; VAS, visual analogue scale; FMS, functional movement screening.

DISCUSSION

The primary purpose of this study is to determine the relationship between the ODI, VAS, trunk extensor endurance tests, and FMS in subjects with NCLBP, and the secondary purpose was to quantify and integrate their physical activity levels. We assessed physical functions that combined functional abilities through FMS. In the seven FMS tasks, active straight leg raise was used to assess the flexibility of the hamstring and the calf muscle, and push-up and rotary stability were used to assess trunk stability. Deep squat was used to assess the coordination of core stability and extremities, and the inline lunge and hurdle step were used to assess trunk stability, gluteal strength, proprioception, balance, and hip, knee, and ankle mobility.[16]

The total FMS score of all participants ranged from 7-16. The average was 10.62 of a possible total of 21,[2,21] Previous studies found a significant direct relationship between a history of LBP and decreased ASLR.[19] Shum et al. reported limited motion in the hip and lumbar spine of subjects with CLBP during sit-to-stand and stand-to-sit motions.[13] Sung et al. suggested significantly decreased kinetic and kinematic stability, poor balance performance, and an altered proprio-

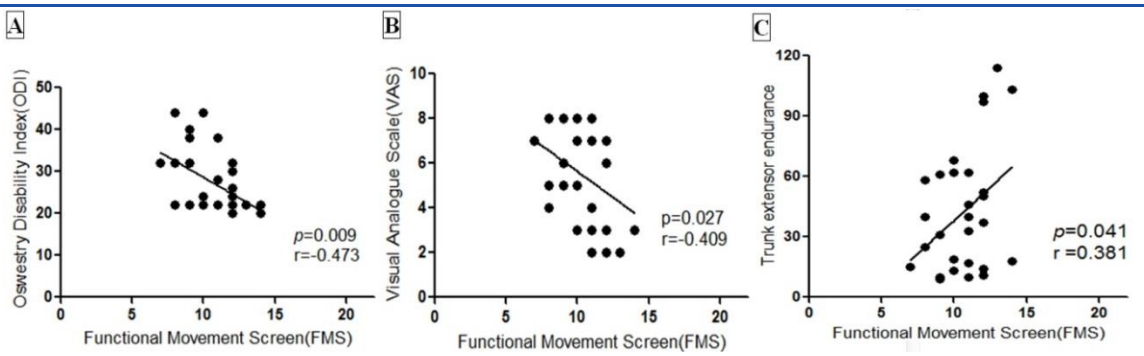

Figure 3. Correlation of ODI, VAS, trunk extensor endurance test, and FMS.
(A) Correlation of ODI and FMS scores, (B) Correlation of VAS and FMS scores, (C) Correlation of trunk extensor endurance and FMS score.

ceptive postural control during one leg standing exercises in subjects with CLBP.[22] Other studies reported decreased spinal mobility, endurance, strength, and physical fitness in the CLBP population.[23-25] In our study, low total FMS scores may be associated with deficit movement or disability in subjects with CLBP.[2,15]

There was a statistically significant relationship between back endurance times and FMS scores (r=0.381). Possible reasons for these results may be poor back extensor muscle endurance and impaired body movement and coordination. Back endurance was measured as the total time subjects were able to maintain an unsupported trunk on a horizontal examination table. Trunk muscles play an important role in supporting and stabilizing the lumbar spine.[26,27] Poor back extensor muscle endurance is related to a low fatigue threshold[1] and causes uncontrollable trunk movement.[26] Mitchell et al. found that total FMS scores were associated with core strength and dynamic posture.[18] FMS measured trunk stability through push-ups, rotary stability, deep squats, inline lunges, and hurdle steps.[2,15,16] Based on the results of the current investigation, FMS is a useful tool for determining and integrating the functional movement capabilities of the population with CLBP and could add valuable information for subjects with CLBP. We believe that FMS may assist to design more effective individualized treatment plans to improve the functional capacity of subjects with CLBP.

We found a statistically significant but small (r=−0.41) negative correlation between VAS and FMS scores. There was also a negative (r=−0.473) correlation between ODI and FMS scores. The ODI score was measured as the total score in a questionnaire about the functional status and pain involved in daily activities. Subjects with CLBP have decreased postural control, spinal mobility, endurance, strength, and physical fitness.[23-25] Originally, it was developed as a screening tool for football players[17] and predicted their injuries if their scores were 14 or less.[2] Our results should be significant for the clinical setting because FMS averaged approximately 10. Our results may be clinically meaningful for subjects with NCLBP, as it may assist the evaluation of their physical functions. Further, the relationship between self-reported (ODI and VAS) and clinical measures (FMS) may assist in the design of preventive programs associated with decreased functional movement.

However, our results did not confirm the results of left-right asymmetry nor calculate the score of each task. Therefore, we will not provide information about specific disabilities nor the functional characteristics of participants. In addition, the sample size was small in this study. Further research is needed to compare FMS scores between healthy subjects and subjects with LBP.

CONCLUSIONS

Our study identified the relationship between trunk endurance and VAS or ODI and FMS. The results showed a small negative correlation between VAS score and FMS score. There was also a negative correlation between ODI and FMS. There was a positive relationship between back endurance time and FMS. Therefore, FMS may assist in designing more effective individualized treatment plans to improve the functional capacity of subjects with CLBP.

Key Points

Question Can FMS scores evaluate the physical function of subjects with CLBP and to identify a relationship between the VAS and FMS, the ODI and FMS, and trunk endurance and FMS?

Findings There was a statistically significant negative correlation between FMS and ODI scores, and the FMS and VAS scores, respectively. The back endurance positively correlated with FMS scores.

Meaning FMS may assist in designing more effective individualized treatment plans to improve the functional capacity of subjects with CLBP.

Article information

Conflict of Interest Disclosures: None.
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